LINEAR ADJUSTABLE ACTIVE HEAD RESTRAINT

DESCRIPTION

Technical Field

[Para 1] The present invention relates generally to an automotive seat assembly and more particularly to an automotive seat assembly with a linear adjustable head restraint.

Background of the Invention

[Para 2] Automotive design is guided by a never-ending goal of improving the safety and comfort of passengers traveling within the vehicles. As the nature of existing vehicular travel precludes the ability to completely eliminate incidents of collision during operation, automotive designers pursue design improvements to minimize the impact of such collisions on the internal passengers. These design improvements often are located in a wide variety of components within the automobile. They may include a variety of features and functions from intrusion reduction to momentum absorbance.

[Para 3] One such category involves the use of energy seat impact response devices. These devices are utilized to protect passengers during collision. One example are safety mechanisms designed to move the head restraint forward in order to engage the passenger's head during rear-impact scenarios. By actively engaging the passenger's head, momentum from the passenger's head can be reduced and thereby further insure the comfort and safety of the passenger during collision. These safety mechanisms are commonly operated by rotating the head restraint assembly forward to engage the passenger. The nature of most head restraint shapes dictate that as they rotate the profile of their engagement surface with change. Additional designs considerations, therefore, must be imposed on the overall head restraint shape and design.

[Para 4] An improve approach would be to allow the head restraint assembly to be adjusted t coincide with an individual occupant's personal comfort and preferences. When the safety mechanism is deployed, it would be preferable that the head restraint be brought forward while retaining the configuration set for such personal comfort and preference. In this scenario the head restraint assembly would be properly configured to engage an occupants head even during forward-engaging motion. This could be accomplished by

isolating the fore/aft motion necessary for engagement during impact from the adjustment features necessary for comfort. If combined with adjustment features that allowed the static distance from an occupant's head to the head restraint to be minimized, the pure linear forward engaging motion could be utilized to reduce engagement time during impact. This, in turn, could result in a further reduction in occupant realized stress which would be highly desirable.

Summary of the Invention

[Para 5] It is, therefore, an object of the present invention to provide an automotive seat assembly with an adjustable head restraint assembly. It is a further object of the present invention to provide such a head restraint assembly that includes an active forward engagement feature providing pure linear forward engagement action.

[Para 6] An automotive seat assembly is provided including a seatbase defining a seatbase plane and a seatback defining a seatback plane. A head restraint support member is configured to extend vertically from the seatback. The head restraint support member has a vertical extension portion extending generally parallel to the seatback plane, at least one horizontal travel arm generally perpendicular to the seatback plane, and a horizontal base arm. A head restraint inner structure engages the at least one horizontal travel arm and is movable linearly to a plurality of positions along the at least one horizontal travel arm. An active head restraint element is mounted to the head restraint inner structure and the horizontal base arm and is movable between a stowed position and a deployed position. The active head restraint element moves the head restraint inner structure to a head restraint forward position in response to moving into the deployed position. The active head restraint restraint element is biased towards the deployed position. A trigger element retains the active head restraint element in the stowed position and releases the active head restraint element during vehicle impact.

[Para 7] Other objects and features of the present invention will become apparent when viewed in light of the detailed description of the preferred embodiment when taken in conjunction with the attached drawings and appended claims.

Brief Description of the Drawings

[Para 8] FIGURE 1 is an illustration of an automotive seat assembly in accordance with the present invention.

[Para 9] FIGURE 2 is a detailed illustration of the head restraint assembly for use in the automotive seat assembly illustrated in Figure 1, the head restraint assembly illustrated in the active head restraint element stowed position.

[Para 10] FIGURE 3 is a detailed illustration of the head restraint assembly for use in the automotive seat assembly illustrated in Figure 1, the head restraint assembly illustrated in the active head restraint element deployed position.

[Para 11] FIGURE 4 is a detailed illustration of the active head restraint element illustrated in Figure 1-3.

[Para 12] FIGURE 5 is an illustration of a head restraint assembly for use in the automotive seat assembly illustrated in Figure 1.

[Para 13] FIGURE 6 is a detailed illustration of a portion of the head restraint assembly illustrated in Figure 5, the detail illustrating the rear head restraint inner structure removed.

[Para 14] FIGURE 7 is a detailed illustration of a portion of the head restraint assembly illustrated in Figure 6, the detail illustrating the forward head restraint inner structure removed.

[Para 15] FIGURE 8 is an alternate embodiment of the detailed illustration shown in Figure 6, the detail illustrating the use of a motor assembly.

Description of the Preferred Embodiment(s)

[Para 16] Referring now to Figure 1, which is an illustration of an automotive seat assembly 10 in accordance with the present invention. The automotive seat assembly 10 illustrated is intended to encompass a wide variety of seating configurations for both front and read automotive seats. The seat assembly 10 includes a seatback 12 defining a seatback plane 14 as well as a seatbase 16 defining a seatbase plane 18 as is well understood in the art. The seat assembly 10 is configured for the presence of an occupant 20. A head restraint assembly 22 is intended for use in conjunction with the seatback 12 for further passenger 20 comfort and safety. The present invention provides a unique and beneficial head restraint assembly 22 to provide an increase in the comfort and safety of the automotive seat assembly 10.

[Para 17] Modern seat design requirements often require the integration of a seatback impact response device 24 within the seat assembly 10. The present invention utilizes this integration in its design of the head restraint assembly 22. The automotive head restraint assembly 22 includes a head restraint support member 24 mounted to and extending vertically from the seatback 12. The head restraint support member 24 may be manufactured in a variety of fashions. However one particular embodiment contemplates a novel two-

piece tubular support member 24 wherein the two pieces can be manufactured using simple machining techniques and joined with a weld 26 to form a single head restraint support member 24. The head restraint support member 24 includes a vertical extension portion 28 commonly comprising two vertical extension arms 30 extending from the seatback upper surface 32 generally parallel to the seatback plane 14. The head restraint support member 24 further includes at least one horizontal travel arm 34 orientated generally perpendicular to the seatback plane 14 and generally perpendicular, therefore, to the vertical extension portion 28. The term generally perpendicular is intended to embody the fact that the horizontal travel arm 34 provide a generally fore/aft orientation within the vehicle. The present invention preferably utilizes two horizontal travel arms 34 formed using tubular elements. A horizontal base arm 36 is positioned between the two horizontal travel arms 34. The advantage of this configuration is that it allows the head restraint support member 24 to be formed by simple bending of a tubular element.

[Para 18] A head restraint inner structure 38 engages the horizontal travel arm(s) 34 such that it is movable along these travel arms 34 linearly through a plurality of position. This gives the head restraint inner structure 38 fore/aft adjustment abilities within the vehicle while retaining its orientation. Although this may be accomplished in a variety of fashions, one embodiment contemplates the use of one or more travel channels 40 formed through the head restraint inner structure 38 (See Figure 3). The travel arms 34 are positioned within the travel channels 40 such that the head restraint inner structure 38 is constrained into linear travel along the horizontal travel arms 34. This configuration helps prevent jamming during movement and insures proper alignment. It is contemplated that the head restraint inner structure 38 be formed from cast polymer although variety of materials and manufacturing techniques are contemplated. In addition, as described above, the travel channels 40 either alone or in combination with stop features 42 may be used to limit motion of the head restraint inner structure.

[Para 19] It is desirable for the head restraint inner structure 38 to not only be movable to a variety of positions along the travel arms 34, but to be secured in each of these plurality of positions as well. To this end, the present invention includes a plurality of engagement notches 44 formed in the at least one travel arm 34. A locking arm 46 is mounted to the head restraint inner structure 38 and includes a locking blade 48 designed to engage one of the plurality of engagement notches 44 when in a locking arm engagement position 50. The locking arm is 46 is additionally movable into a locking arm disengagement position 52 wherein the locking blade 48 moves out of contact with the engagement notches 44 and the head restraint inner structure 38 is free to move along the horizontal travel arm 34. The locking arm 46 is preferably

biased towards the locking arm engagement position 50. A channel guide 54 formed in the head restraint inner structure 38 can act as a guide for the locking blade 48 in addition to preventing rotational torque from being transferred to the locking arm 46. In at least one embodiment, the plurality of engagement notches 42 are unidirectional wherein they only engage in one direction. By way of example, they may be uni-directional such that the head restraint inner structure 38 may be moved forward even when the locking arm 46 is in the locking arm engagement position 50.

[Para 20] The present invention further includes an active restraint element 56 mounted in communication with both the head restraint inner structure 38 and the horizontal base arm 36. The active restraint element 56 is movable between a stowed position 58 (see Figure 2) and a deployed position 60(see Figures 3 and 4). The active restraint element 56 moves the head restraint inner structure 38 forward into a head restraint forward position 60 during vehicle impact to engage the passenger's head, which in turn reduces whiplash and related stressors. Although this may be accomplished in variety of fashions, one embodiment contemplates that the active restraint element 56 is biased towards the deployed position 60. A trigger element 62 is utilized to retain the active head restraint element 56 in the stowed position 58 until the trigger element 62 is activated during vehicle impact. Again, although this may be accomplished in a variety of fashions, one embodiment contemplates the use of a motion translation element 64 positioned within the seatback 12. The motion translation element 64 includes a back intrusion portion 66 which senses the occupants 20 intrusion into the seatback 12 during vehicle impact. The motion translation element 64 rotates and thereby translates the intrusion into a linear force on a cable 68 or similar linkage attached to the trigger element 62. The linkage 68 may be positioned within the head restraint support member 24 when hollow tubing is used to form the head restraint support member 24. The use of uni-directional engagement notches 42 allows the active restraint element 56 to move the head restraint inner surface 38 even if the locking arm 46 is engaged. In alternate embodiments the linkage 68 may be directly connected to the motion translation element 64 and thereby effectuate the movement from stowed 58 to deployed 60 without the requirement of biasing or the use of a trigger element 62. In still another contemplated option, an impact sensor 69 could be used to trip the trigger 62 or move the motion translation element 64.

[Para 21] Although a wide variety of motion translation elements 64 are contemplated, one embodiment contemplates the use of a hinge element 70 movable between a hinge folded position 72 and a hinge unfolded position 74. The folded position 72 and unfolded position 74 are intended to correspond to the stowed 58 and deployed 60 positions respectively. The use of a hinge element 70 allows for a very low profile element when in the stowed/folded

position 72. It is contemplated that a hinge storage compartment 76 formed into the head restraint inner structure 38 works in combination with the hinge style element 70 to maximize the range of motions of the head restraint.

[Para 22] In an alternate embodiment illustrated in Figures 5 through 8, the head restraint inner structure 38 may be comprised of a forward head restraint inner structure 78 and a rear head restraint inner structure 80. In this embodiment the locking arm 46 is mounted to the head restraint support member 24. This may be accomplished in a variety of fashions such as mounting the locking arm 46 to the rear head restraint inner structure 80 which in turn is mounted to the head restraint support member 24. A cam assembly 82 is positioned between the locking arm 46 and the forward head restraint inner structure 78 and is in communication with both the arm 46 and the structure 78 such that rotation of the locking arm 46 rotates the cam assembly 82 and forces the forward head restraint inner structure 78 forward. A head restraint support structure biasing spring 84 can be utilized to bias the head restraint inners structure 38 against the cam assembly 82. This is beneficial as the cam assembly 82 provides forward control of the head restraint inner structure 38 without a rigid physical connection. Therefore, the cam assembly 82 does not interfere with active forward motion of the forward head restraint inner structure 78 effectuated by the active restraint element 56. As shown in Figure 8, a motor assembly 86 may be mounted to the rear head restraint inner structure 80 and control rotation of the locking arm 46. This can be utilized to allow electronic control of the forward head restraint inner structure 78 positioning without interfering with active restraint element 56 actuation.

[Para 23] While particular embodiments of the invention have been shown and described, numerous variations and alternative embodiments will occur to those skilled in the art. Accordingly, it is intended that the invention be limited only in terms of the appended claims.